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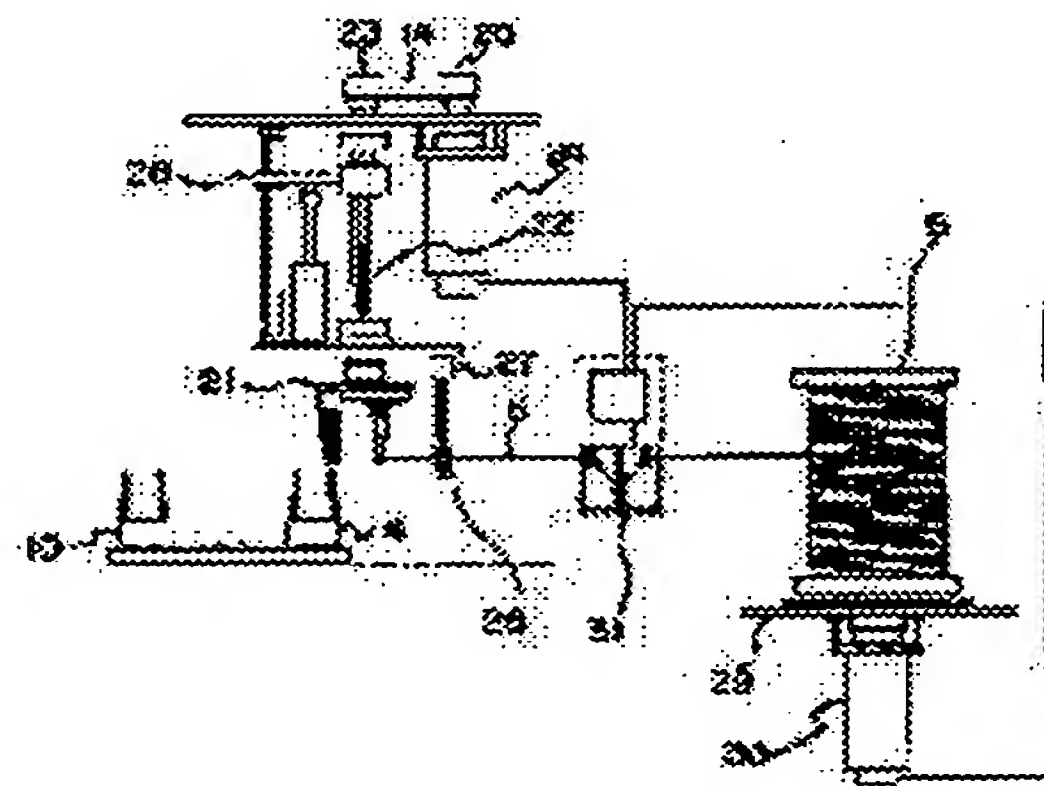
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(54) DEVICE AND METHOD FOR MANUFACTURING STATOR OF ROTARY ELECTRIC MACHINE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device and method for manufacturing stator of rotary electric machine by which a highly reliable stator which is free of incomplete insulation.

SOLUTION: A device for manufacturing stator of rotary electric machine which is provided with a winding means 29 that forms a coil by molding and winding an electric wire around a bobbin and a mechanism 28 which transfers the formed coil to a coil inserting jig, while the mechanism 28 holds the coil in the wound state is provided with a driving means 24 which rotationally drives the bobbin synchronously with the rotation of the wire bobbin which is wound with the electric wire. The device is also provided with a taking-out and inserting mechanism, which takes out the coil transferred to the coil inserting jig 10 and inserts the coil into a stator core.



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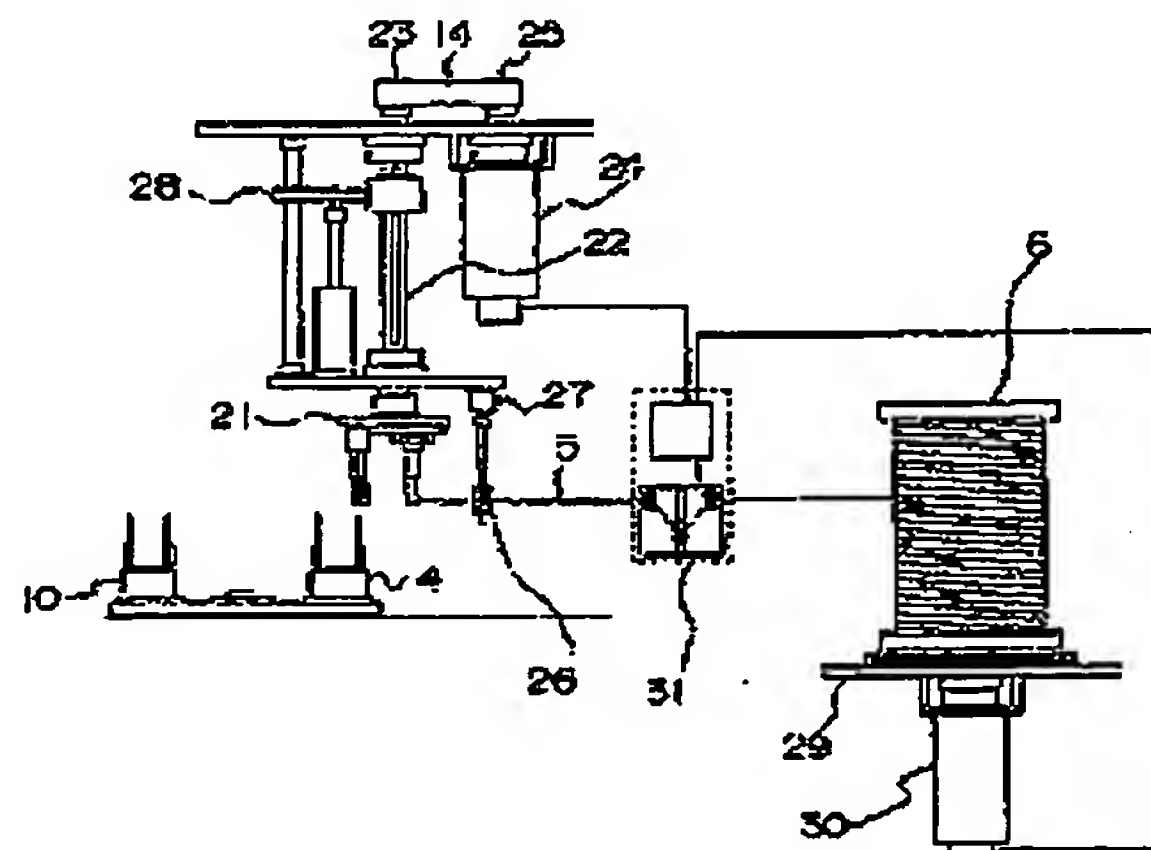
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(54) 【発明の名称】 回転電機の固定子の製造装置及び製造方法

(57) 【要約】

【課題】 絶縁不良のない信頼性の高い回転電機の固定子の製造装置及び製造方法を提供する。

【解決手段】 電線を巻棒に成形巻回してコイルとする巻回手段29と、成形巻回したコイルを巻回した状態に保持してコイル挿入治具に移載する機構28と、を具備する回転電機の固定子の製造装置において、電線を巻回している巻線ボビンの回転と同期させて、前記巻棒を回転駆動させる駆動手段24を備える。また、コイル挿入治具10に移載したコイルを取出して固定子鉄心に挿入する取出挿入機構11を備える。



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## 【特許請求の範囲】

【請求項 1】 電線を巻枠に成形巻回してコイルとする巻回手段と、成形巻回したコイルを巻回した状態に保持してコイル挿入治具に移載する機構と、を具備する回転電機の固定子の製造装置において、前記電線を巻回している電線ボビンの回転と同期させて、前記巻枠を回転駆動させる駆動手段を備えることを特徴とする回転電機の固定子の製造装置。

【請求項 2】 請求項 1 記載の回転電機の固定子の製造装置において、

上記コイル挿入治具に移載したコイルを取出して固定子鉄心に挿入する取出挿入機構を備えることを特徴とする回転電機の固定子の製造装置。

【請求項 3】 請求項 1 又は 2 に記載の回転電機の固定子の製造装置において、

上記巻枠の回転軸は、上記電線ボビンの回転軸と平行に配置されていることを特徴とする回転電機の固定子の製造装置。

【請求項 4】 請求項 1 ～ 3 のいずれか 1 項に記載の回転電機の固定子の製造装置において、

上記電線を上記巻枠に巻回する案内は、巻枠 1 回転毎に電線の外径寸法分のみ巻枠の回転軸と平行に移動する案内移動手段を備えることを特徴とする回転電機の固定子の製造装置。

【請求項 5】 請求項 1 ～ 4 のいずれか 1 項に記載の回転電機の固定子の製造装置において、

上記巻枠の回転速度と上記電線ボビンの回転速度とを制御して、上記案内と電線ボビン間の張力を一定とする速度制御手段を備えることを特徴とする回転電機の固定子の製造装置。

【請求項 6】 電線を巻枠に成形巻回してコイルとし、成形巻回したコイルを巻回した状態に保持してコイル挿入治具に移載する、回転電機の固定子の製造方法において、

前記電線を巻回している電線ボビンの回転と同期させて、前記巻枠を回転させることを特徴とする回転電機の固定子の製造方法。

【請求項 7】 請求項 6 記載の回転電機の固定子の製造方法において、

上記コイル挿入治具に移載したコイルを取出して固定子鉄心に挿入することを特徴とする回転電機の固定子の製造方法。

【請求項 8】 請求項 6 又は 7 に記載の回転電機の固定子の製造方法において、

上記巻枠の回転軸は、上記電線ボビンの回転軸と平行にすることを特徴とする回転電機の固定子の製造方法。

【請求項 9】 請求項 6 ～ 8 のいずれか 1 項に記載の回転電機の固定子の製造方法において、

上記巻枠 1 回転毎に電線の外径寸法分のみ、電線を巻枠の回転軸と平行移動して上記巻枠に案内することを特徴

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とする回転電機の固定子の製造方法。

【請求項 10】 請求項 6 ～ 9 のいずれか 1 項に記載の回転電機の固定子の製造方法において、

上記巻枠の回転と電線ボビンの回転とを制御して、上記案内と電線ボビン間の張力を一定にすることを特徴とする回転電機の固定子の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、回転電機の固定子の製造装置及び製造方法に係り、特に絶縁不良のない高信頼性の固定子の製造装置及び製造方法に関する。

【0002】

【従来の技術】汎用誘導電動機などの回転電機では、その固定子の組立方法として、電線（マグネットワイヤ）を予め所定のコイル形状に成形巻回したコイルを複数個用意し、それらを順次、固定子鉄心のスロットに挿入し、組み合わせて固定子を形成していく方法が従来から使用されている。

【0003】そこで、このような従来の製造装置による固定子の製造方法について、図 9 ～ 図 20 を参照して説明する。図 9 は、従来のフライヤー方式の巻線挿入機の外觀説明図である。図 10 は、従来のフライヤー方式の巻線挿入機の巻枠及びコイル挿入治具の拡大説明図である。図 11 は、従来のフライヤー方式の巻線挿入機のフライヤーによる 1 段目のコイル巻回の説明図である。図 12 は、図 11 におけるブレード、ウェッジガイドと巻枠との関係説明図である。図 13 は、従来のフライヤー方式の巻線挿入機のフライヤーによる 2 段目のコイル巻回の説明図である。図 14 は、図 13 におけるブレード、ウェッジガイドと巻枠との関係の説明図である。図 15 は、従来のフライヤー方式の巻線挿入機のフライヤーによる 3 段目のコイル巻回の説明図である。図 16 は、図 15 におけるブレード、ウェッジガイドと巻枠との関係の説明図である。図 17 は、従来のフライヤー方式の巻線挿入機のコイル挿入治具にコイルを移載した状態の説明図である。図 18 は、従来のフライヤー方式の巻線挿入機のコイル挿入治具に移載したコイルの概略説明図である。図 19 は、従来のフライヤー方式の巻線挿入機において、2 極目のコイルの巻回の状態の説明図である。図 20 は、従来のフライヤー方式の巻線挿入機において、複数極の巻回が完了した状態の説明図である。

【0004】従来例の回転電機の固定子の製造装置を図 9 に示す。1 は回転するフライヤー、2 はフライヤーの先端に取り付けてあるノズル、3 は巻枠、4 は成形巻回位置にあるコイル挿入治具、5 は電線、6 は電線ボビン、7 は電線経路、8 はフライヤー駆動モータ、9 はターンテーブル、10 は挿入位置にあるコイル挿入治具、11 はコイル挿入装置である。図 10 において、12 はフライヤー駆動モータ 8 に取り付けられたタイミングブ



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ーリ、13はフライヤーに取り付けられたタイミングブ  
ーリ、14は回転駆動を伝達するタイミングベルト、1  
5は環状に配置されたブレード、16はブレード15に  
接して環状に配置されたウェッジガイドである。

【0005】以上のように構成された従来のフライヤー  
方式の巻線挿入機について、以下、その成形巻回動作と  
コイル挿入治具4へのコイルの移載動作と固定子鉄心へ  
の挿入動作について説明する。図11において、17は  
巻枠3の一部でコイル挿入治具4のブレード15にわず  
かな隙間をもって突入可能な構造をもった固定巻枠、1  
8はその相手側となる移動巻枠である。まず、図11、  
12に示すように、複数段に構成された巻枠3のうち1  
段目がコイル挿入治具4のブレード15に突入し、巻枠  
3の外周をフライヤー1が回転する。ノズル2から導出  
された電線5を巻枠3の1段目に所定回数成形巻回し  
た後、図13、14に示すように、巻枠3が下降し、次  
に巻枠3の2段目に所定回数巻回する。図15、16に  
示すように、これを複数段分繰り返した後、図17、1  
8に示すようにフライヤー1が停止し、かき落とし治具  
19により成形巻回したコイルをコイル挿入治具4のブ  
レード15に移載し、巻枠3が上昇し、1極目の巻線が  
完了する。次に、図19において、コイル挿入治具4が  
回転し、1極目と同様に2極目の巻線を行う。図20は  
複数極の成形巻回が完了した状態を示す。次に、複数極  
成形巻回したコイル20を搭載したコイル挿入治具4を  
ターンテーブル9を回転することにより、所定のコイル  
挿入位置に移載した後、図示しない固定子鉄心をコイル  
挿入治具4のブレード15に介しセットし、コイル挿入  
装置11により、コイル20を固定子鉄心に挿入し、1  
相分の巻線、挿入が完了となる。以上の動作を必要相分  
のみ繰り返し、固定子が完成する。

【0006】上記従来例は、固定子コイルの成形巻回、  
挿入に伴う固定子コイル、スロット内絶縁物の損傷発生  
について十分な配慮がされているとは言えず、絶縁性能  
保持の点に問題があった。特に、近年は、回転電機の小  
形化、高効率化が叫ばれ、固定子でのスロット内コイル  
占積率（以下、「占積率」という。）を高める傾向にあ  
るが、この場合は1個スロット内に挿入すべき電線の本  
数が多くなり、この結果、成形巻回したコイルの挿入に  
伴う電線の絶縁被膜、スロット内絶縁物の損傷発生頻度  
が異常に高くなってしまふ。これは、従来技術では、電  
線はフライヤーの回転により電線ボビンから巻戻してい  
るが、回転するフライヤーに取付けられたノズルから排  
出する電線に捻じれが生じる。また、フライヤーの加減  
速により電線に過度の張力を付加してしまい硬度が増  
し、また、伸びが生じるため、電線の絶縁被膜が損傷し  
やすくなるからである。また、コイル挿入治具のブレード  
にかき落とされたコイルのうち、固定巻枠に対し移動  
巻枠側で成形巻回された電線は成形巻回された順番で配  
置されないため、固定子鉄心のスロット内に挿入される

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過程。また、挿入後において電線同士の交わりが多発  
し、結果、本来より高い占積率となり固定子コイル、ス  
ロット内絶縁物が損傷しやすくなるからである。そし  
て、この結果、絶縁不良が多発し、信頼性の低下と、歩  
留まりの低下によるコストの上昇が免れなくなってしまう  
という問題が生じてしまふ。

【0007】また、回転電機の巻線装置として、巻枠と  
電線ボビンとを同期して回転させることは、特開平2-  
261037号公報等で提案されており、電線の案内を  
巻枠1回転毎に電線の外径寸法分のみ巻枠の回転軸と平  
行移動させることも、特開昭63-42109号公報等  
で提案されているが、これらは、コイル挿入治具に移載  
する機構等について、考慮していない。

【0008】

【発明が解決しようとする課題】本発明は、上記従来技  
術の問題に鑑みてなされたもので、その目的は、絶縁不  
良のない信頼性の高い回転電機の固定子の製造装置及び  
製造方法を提供することにある。

【0009】

【課題を解決するための手段】本発明は、電線を巻枠に  
成形巻回してコイルとする巻回手段と、成形巻回したコ  
イルを巻回した状態に保持してコイル挿入治具に移載す  
る機構と、を具備する回転電機の固定子の製造装置にお  
いて、前記電線を巻回している電線ボビンの回転と同期  
させて、前記巻枠を回転駆動させる駆動手段を備える回  
転電機の固定子の製造装置である。

【0010】また、本発明は、上記コイル挿入治具に移  
載したコイルを取出して固定子鉄心に挿入する取出挿入  
機構を備える回転電機の固定子の製造装置である。

【0011】そして、本発明は、上記巻枠の回転軸は、  
上記電線ボビンの回転軸と平行に配置されている回転電  
機の固定子の製造装置である。

【0012】更に、本発明は、上記電線を上記巻枠に巻  
回する案内は、巻枠1回転毎に電線の外径寸法分のみ巻  
枠の回転軸と平行に移動する案内移動手段を備える回転  
電機の固定子の製造装置である。

【0013】また、本発明は、上記巻枠の回転速度と上  
記電線ボビンの回転速度とを制御して、上記案内と電線  
ボビン間の張力を一定とする速度制御手段を備える回転  
電機の固定子の製造装置である。

【0014】そして、本発明は、電線を巻枠に成形巻回  
してコイルとし、成形巻回したコイルを巻回した状態に  
保持してコイル挿入治具に移載する。回転電機の固定子  
の製造方法において、前記電線を巻回している電線ボビ  
ンの回転と同期させて、前記巻枠を回転させる回転電機  
の固定子の製造方法である。

【0015】更に、本発明は、上記コイル挿入治具に移  
載したコイルを取出して固定子鉄心に挿入する回転電機  
の固定子の製造方法である。

【0016】また、本発明は、上記巻枠の回転軸は、上

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記電線ボビンの回転軸と平行にする回転電線の固定子の製造方法である。

【0017】そして、本発明は、上記巻枠1回転毎に電線の外径寸法分のみ、電線を巻枠の回転軸と平行移動して、上記巻枠に案内する回転電線の固定子の製造方法である。

【0018】更に、本発明は、上記巻枠の回転と電線ボビンの回転とを制御して、上記案内と電線ボビン間の張力を一定にする回転電線の固定子の製造方法である。

【0019】

【発明の実施の形態】本発明の発明の実施の形態を説明する。本発明の実施例を図面を用いて、説明する。図1は、実施例における固定子の製造装置の一例の外観説明図である。図2は、図1の装置の構成要素の位置関係を示す説明図である。図3は、実施例における1段目のコイル巻回開始の説明図である。図4は、実施例における2段目のコイル巻回開始の説明図である。図5は、実施例におけるコイル移載開始の説明図である。図6は、実施例におけるコイル移載の説明図である。図7は、実施例におけるコイル移載完了の説明図である。図8は、実施例における複数極のコイル巻回が完了し、コイル挿入治具に移載したコイルの概略説明図である。

【0020】本発明の回転電線の固定子の製造装置の実施例について、説明する。本実施例の回転電線の固定子の製造装置は、電線を巻枠に成形巻回してコイルとする巻回手段と、成形巻回したコイルを巻回した状態に保持してコイル挿入治具に移載する機構と、前記電線を巻回している電線ボビンの回転と同期させて、前記巻枠を回転駆動させる駆動手段と、上記コイル挿入治具に移載したコイルを取出して固定子鉄心に挿入する取出挿入機構と、を具備しており、上記巻枠の回転軸は、上記電線ボビンの回転軸と平行に配置され、また、上記電線を上記巻枠に巻回する案内は、巻枠1回転毎に電線の外径寸法分のみ巻枠の回転軸と平行に移動する案内移動手段を備えており、そして、上記巻枠の回転速度と上記電線ボビンの回転速度とを制御して、上記案内と電線ボビン間の張力を一定とする速度制御手段を備えている。図1、図2において、21は回転する巻枠、22は巻枠21の回転軸、23は回転軸22に取付られたタイミングブリー

【0021】ノズル移動機構27はノズル26が巻枠21の回転軸22と平行移動するように配置され、電線ボ

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ビン回転駆動装置29は巻枠21の回転軸22と電線ボビン6の回転軸が平行になるように配置され、電線5の張力は張力一定制御装置31によって巻枠回転駆動モータ24と電線ボビン回転駆動モータ30の回転速度を制御されている。

【0022】以上のように構成された本実施例の回転電線の固定子の製造装置における、コイル成形巻回動作とコイル挿入治具へのコイル移載動作、固定子鉄心へのコイル挿入動作について、以下、図3～図8を参照して説明する。

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【0023】図3において、21aは巻枠21の一部でコイル挿入治具4のブレード15とウェッジガイド16にわずかな隙間をもって突入可能な構造を持ち、回転軸22を中心に回転する固定巻枠、21bはその相手側となり、回転軸22を中心に固定巻枠21aと同期して回転する移動巻枠である。

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【0024】まず、複数段に構成された巻枠21のうち、1段目21cの端面位置21c'より僅かに高い位置に電線5がくるようにノズル26を配置し、電線5の末端付近5aを図示しない電線保持具で保持した状態で、巻枠回転駆動モータ24により巻枠21を回転させ、その回転によってノズル26より導出された電線5を巻枠21の外周形状に沿って巻き取っていく。このとき、巻枠21が1回転する毎に、ノズル26はノズル移動機構27により、電線5の仕上外径寸法分のみ巻枠21の回転と同期して上方へ移動する。これによって、電線5同士の間隔が一定になり、また、電線5の張力を一定に保つことができる。また、巻枠21の回転軸22と電線ボビン6の回転軸とが平行に配置されているため、電線5を巻くことができない。この動作を必要巻回数分繰り返して1段目21cの巻回が完了し、巻枠21が図4に示す所定の位置で停止する。次に、ノズル26は、ノズル移動機構27により複数段に構成された巻枠21の2段目21dの端面位置21d'に移動し、1段目21cの成形巻回動作と同様の動作を必要巻回数分繰り返して、図5に示すように巻枠21が所定の位置で停止して、成形巻回完了となる。以後、必要に応じ巻枠21に段を設け、同様の動作を繰り返せばよい。

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【0025】ここで、巻枠21の回転によってノズル26から導出される電線5は、ノズル26と電線ボビン6間に配置された張力一定制御装置31により、電線5の張力を検出し、その張力に応じて巻枠回転駆動モータ24の回転速度と電線ボビン回転駆動モータ30の回転速度を制御し、電線5を巻戻し（送出し）するので、巻回開始および終了時の巻枠回転駆動モータ24の加減速、ノズル26から見た巻枠21の1回転中での回転速度の変化に拘らず、常に電線5の張力が一定に保たれる。これによって、電線5に過度の張力を付加しないため、電線5の過度の伸び、また、硬さが増すことを最小限に防止

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できる。

【0026】次に、コイル挿入治具4へのコイル移載動作について図5～図8で説明する。成形巻回が完了した巻棒21は、成形巻回したコイル32をその状態に保持したまま、コイル移載機構28により、固定巻棒21aの隙間21eに、コイル成形巻回位置にあるコイル挿入治具4のブレード15とウェッジガイド16に沿って下降させ、成形巻回したコイル32の最上段のコイル32aがコイル挿入治具4のウェッジガイド16の先端16aに充分収納される位置まで下降停止し、移動巻棒21bが固定巻棒21aの方向に平行移動することによって、移動巻棒21bとコイル32間に隙間17が設けられ、この状態で図示しない電線保持具で電線の末端付近5aより電線切断点5bに持ち替え、図示しない電線切断具で電線5を切断した後、図7に示すようにコイル移載機構28により上方の定位置に移動することにより、巻棒21が上昇定位置に戻り、1極目のコイル32の移載が完了する。

【0027】次に、一極目のみのコイル32を移載したコイル成形巻回位置にあるコイル挿入治具4を二極目の位置に回転し、以上の成形巻回、移載の動作を必要極数繰り返して成形巻回、移載が完了となる。図8は複数極のコイル32の成形巻回が完了し、コイル挿入治具に移載した状態を示す。

【0028】その後、ターンテーブル9を回転させコイル成形巻回位置にあるコイル挿入治具4をコイル挿入位置に移動し、コイル挿入装置11によりコイル32を図示しない固定子鉄心のスロットに挿入し、一相分のコイル32を収納する。以上の成形巻回、移載、挿入、収納の動作を必要相分のみ繰り返し、固定子コイルを備えた固定子が完成する。

【0029】このように、本実施例では、従来技術のように、電線を捻りながら、また、伸びや硬度を増すようにしながら成形巻回を行うのではないから、固定子コイル挿入治具のブレードに整列を保持したまま移載できる。従って、固定子鉄心のスロット内にコイルを挿入収納してもスロット内の電線同士の交わりを減少できるため、電線およびスロット内絶縁物に損傷を与えることがない。

【0030】

【発明の効果】本発明によれば、電線の捻り、伸びを最小限で成形巻回し、コイル挿入治具に整列に保持しているので、スロット内での電線の交わりを減少するように挿入でき、この結果、絶縁不良のない高信頼性の固定子を容易に得ることができる。

【図面の簡単な説明】

【図1】実施例における固定子の製造装置の一例の外観説明図。

【図2】図1の装置の構成要素の位置関係を示す説明図。

【図3】実施例における1段目のコイル巻回開始の説明図。

【図4】実施例における2段目のコイル巻回開始の説明図。

【図5】実施例におけるコイル移載開始の説明図。

【図6】実施例におけるコイル移載の説明図。

【図7】実施例におけるコイル移載完了の説明図。

【図8】実施例における複数極のコイル巻回が完了し、コイル挿入治具に移載したコイルの概略説明図。

【図9】従来のフライヤー方式の巻線挿入機の外観説明図。

【図10】従来のフライヤー方式の巻線挿入機の巻棒及びコイル挿入治具の拡大説明図。

【図11】従来のフライヤー方式の巻線挿入機のフライヤーによる1段目のコイル巻回の説明図。

【図12】図11におけるブレード、ウェッジガイドと巻棒との関係説明図。

【図13】従来のフライヤー方式の巻線挿入機のフライヤーによる2段目のコイル巻回の説明図。

【図14】図13におけるブレード、ウェッジガイドと巻棒との関係の説明図。

【図15】従来のフライヤー方式の巻線挿入機のフライヤーによる3段目のコイル巻回の説明図。

【図16】図15におけるブレード、ウェッジガイドと巻棒との関係の説明図。

【図17】従来のフライヤー方式の巻線挿入機のコイル挿入治具にコイルを移載した状態の説明図。

【図18】従来のフライヤー方式の巻線挿入機のコイル挿入治具に移載したコイルの概略説明図。

【図19】従来のフライヤー方式の巻線挿入機において、2極目のコイルの巻回の状態の説明図。

【図20】従来のフライヤー方式の巻線挿入機において、複数極の巻回が完了した状態の説明図。

【符号の説明】

- 1 フライヤー
- 2 ノズル
- 3 巻棒
- 4 コイル挿入治具
- 5 電線
- 5a 末端付近
- 6 電線ボビン
- 7 電線経路
- 8 フライヤー駆動モータ
- 9 ターンテーブル
- 10 コイル挿入治具
- 11 コイル挿入装置
- 12 タイミングブーリ
- 13 タイミングブーリ
- 14 タイミングベルト
- 15 ブレード

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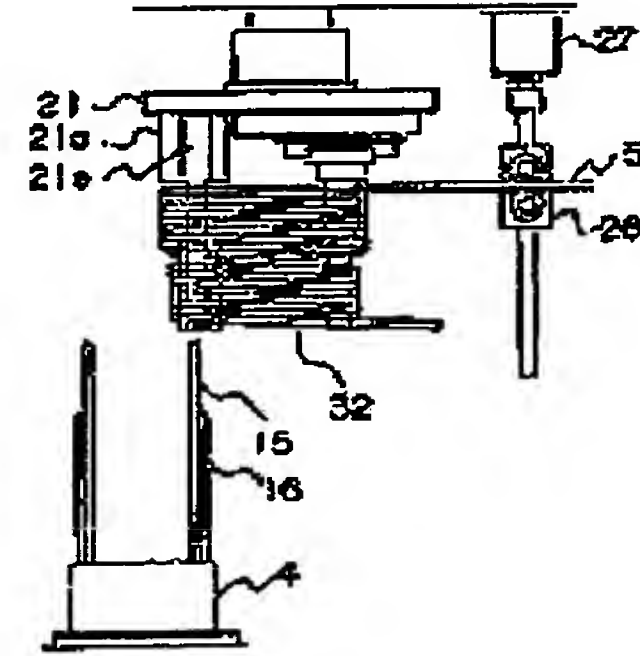
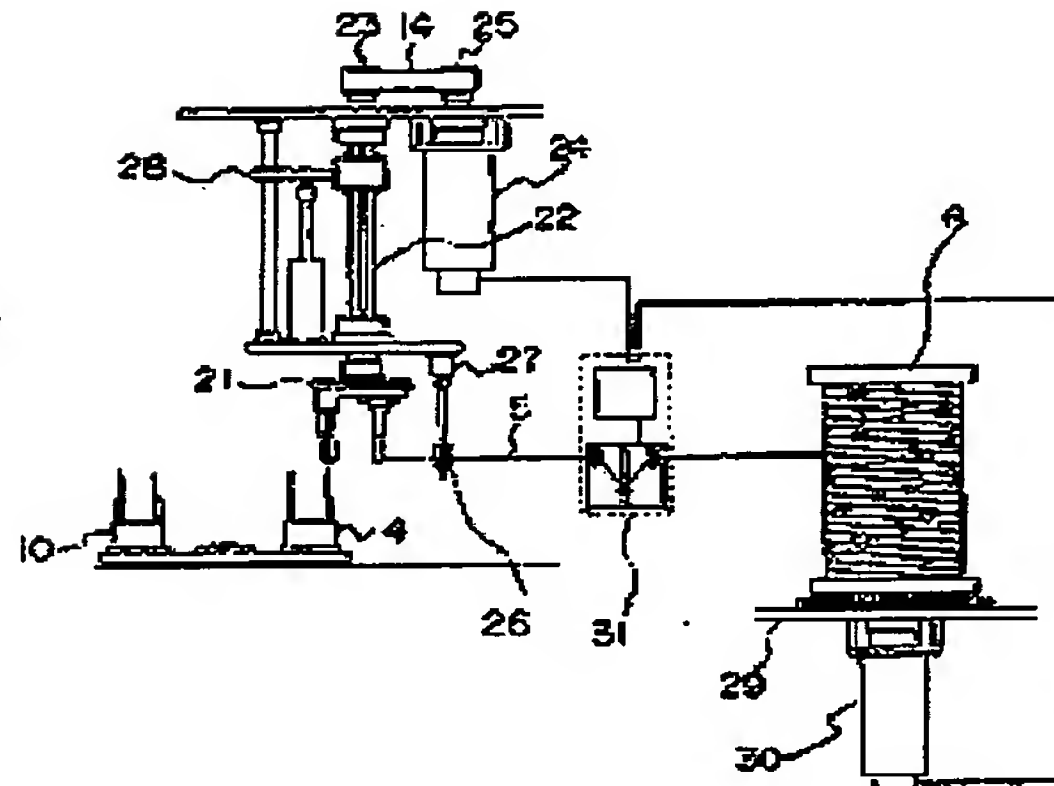
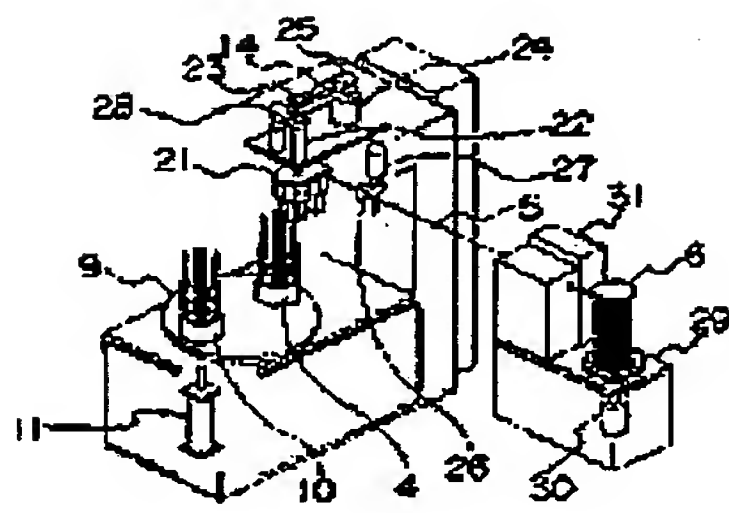
16 ウェッジガイド  
 16a 先端  
 17 固定巻枠  
 18 移動巻枠  
 19 かき落とし用具  
 20 コイル  
 21 巻枠  
 21a 固定巻枠  
 21b 移動巻枠  
 21c 1段目  
 21c' 端面位置  
 21d 2段目  
 21d' 端面位置

\* 21e 隙間  
 22 回転軸  
 23 タイミングブーリ  
 24 巻枠回転駆動モータ  
 25 タイミングブーリ  
 26 ノズル  
 27 ノズル移動機構  
 28 コイル移動機構  
 29 高線ボビン回転駆動装置  
 30 高線ボビン回転駆動モータ  
 31 張力一定制御装置  
 32 コイル  
 \* 32a 最上段のコイル

【図1】

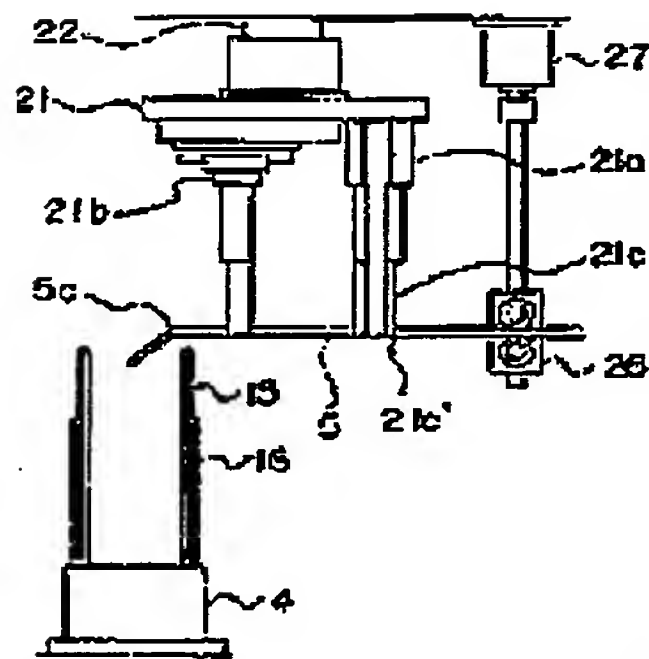
【図2】

【図5】



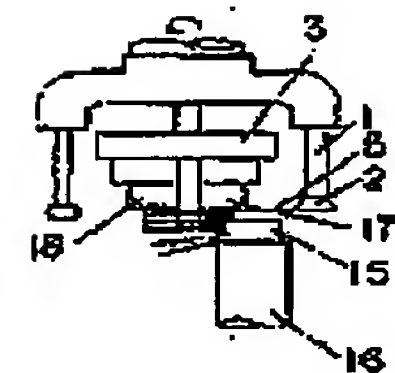
【図3】

【図11】

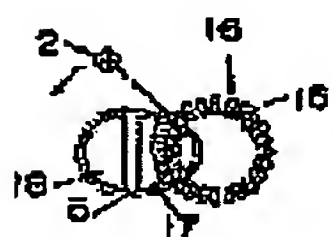
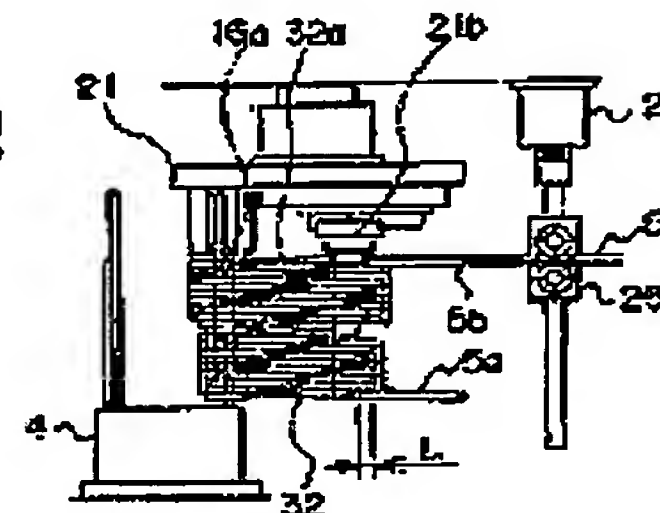
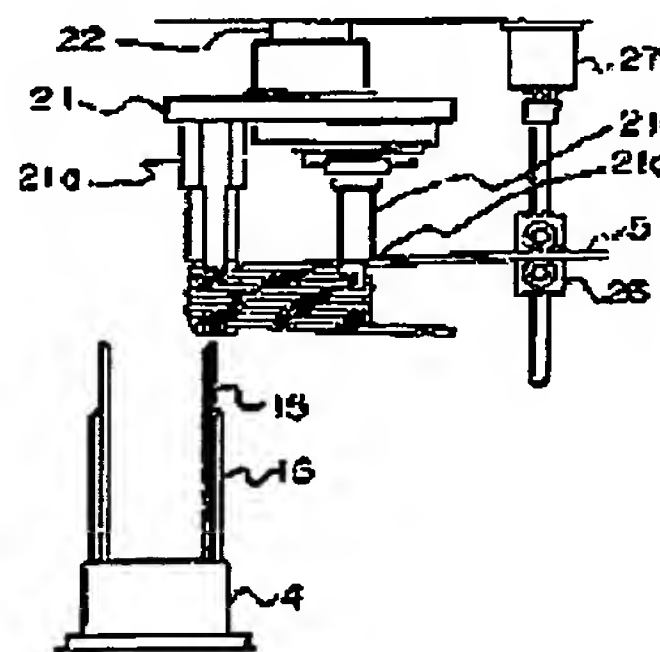


【図4】

【図6】



【図12】

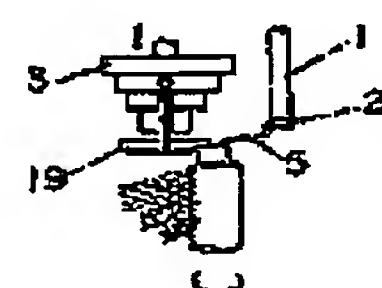
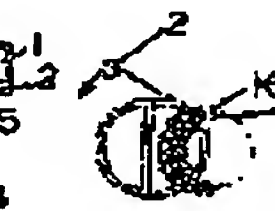
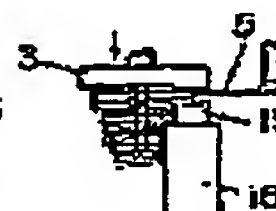
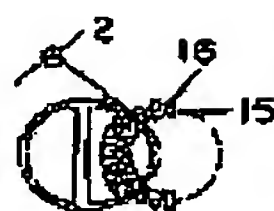
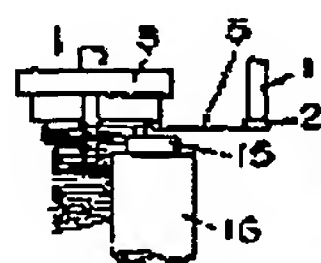


【図13】

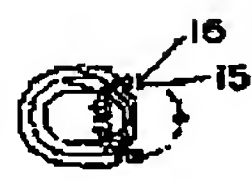
【図14】

【図15】

【図16】



【図18】

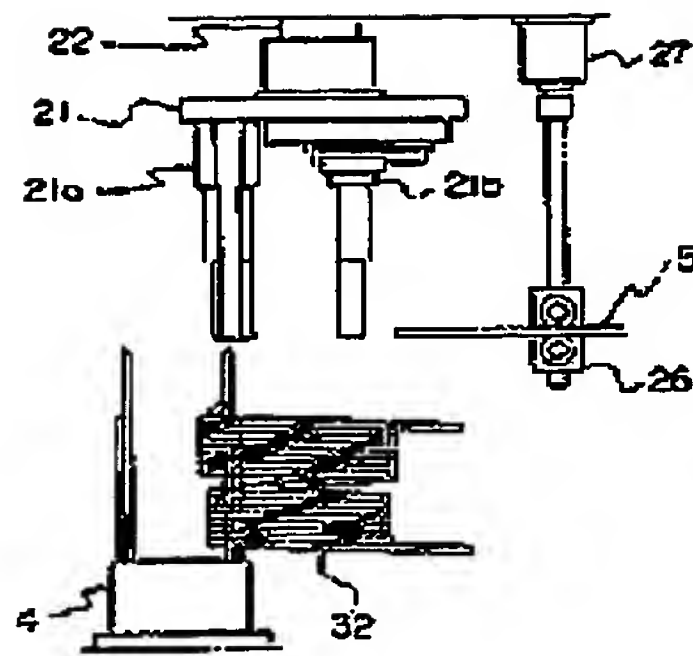




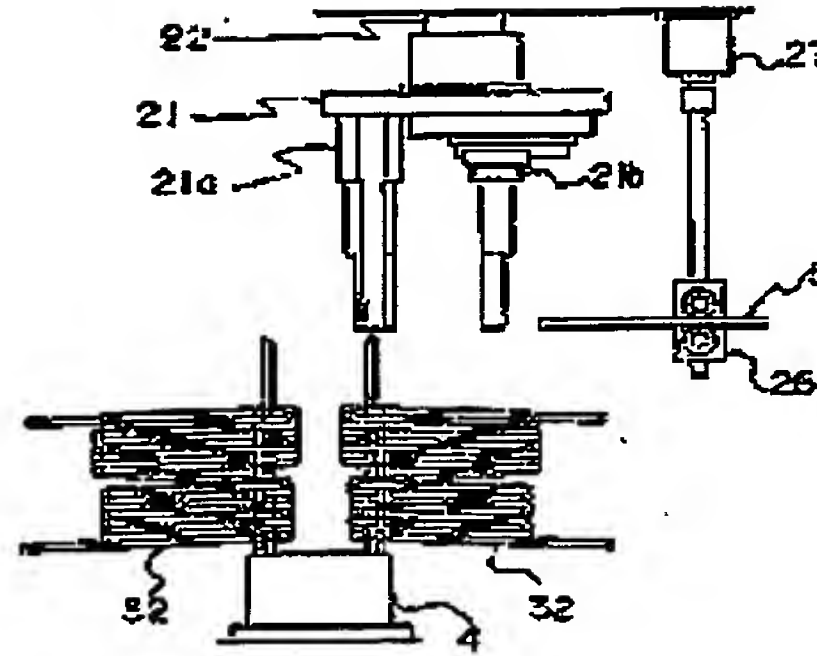
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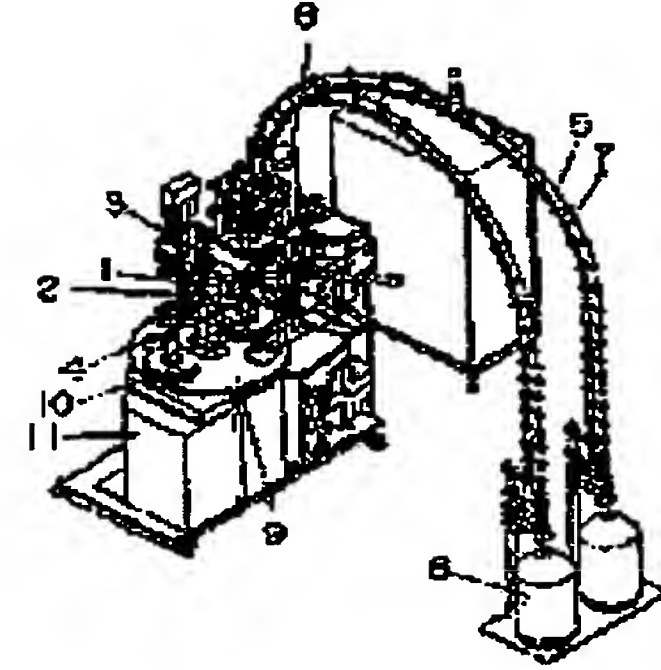
【図7】



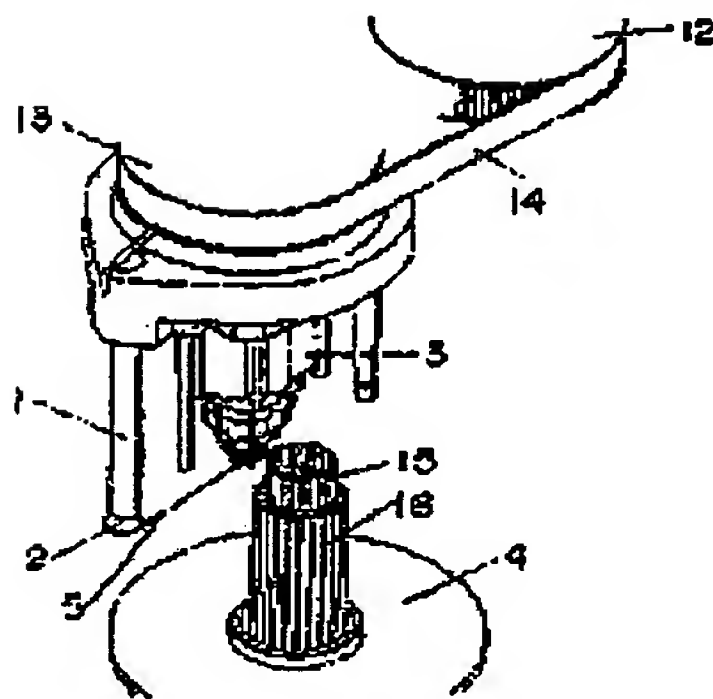
【図8】



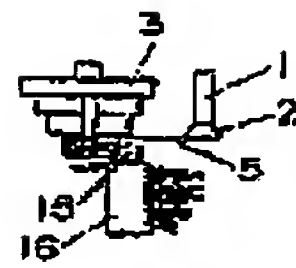
【図9】



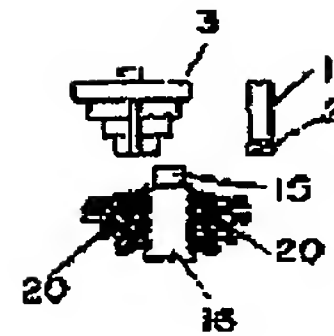
【図10】



【図19】



【図20】



フロントページの続き

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The manufacturing installation of the stator of the dynamo-electric machine carry out having the driving means which makes it synchronize with rotation of the electric-wire bobbin which is winding said electric wire in the manufacturing installation of the stator possessing the winding means which carries out shaping winding and uses an electric wire as a coil at a winding frame, and the device which holds in the condition wound the coil which carried out shaping winding, and is transferred to a coil insertion fixture of a dynamo-electric machine, and carries out the rotation drive of said winding frame as the description.

[Claim 2] The manufacturing installation of the stator of the dynamo-electric machine characterized by having the extraction insertion mechanism which takes out the coil transferred to the above-mentioned coil insertion fixture in the manufacturing installation of the stator of a dynamo-electric machine according to claim 1, and is inserted in a stator core.

[Claim 3] It is the manufacturing installation of the stator of the dynamo-electric machine characterized by arranging the revolving shaft of the above-mentioned winding frame at the revolving shaft of the above-mentioned electric-wire bobbin, and parallel in the manufacturing installation of the stator of a dynamo-electric machine according to claim 1 or 2.

[Claim 4] The guidance which winds the above-mentioned electric wire around the above-mentioned winding frame in the manufacturing installation of the stator of a dynamo-electric machine given in any 1 term of claims 1-3 is the manufacturing installation of the stator of the dynamo-electric machine characterized by having a guidance migration means to move to the revolving shaft of a winding frame, and parallel by the outer-diameter dimension of an electric wire for every winding frame rotation.

[Claim 5] The manufacturing installation of the stator of the dynamo-electric machine characterized by controlling the rotational speed of the above-mentioned winding frame, and the rotational speed of the above-mentioned electric-wire bobbin, and having the speed-control means which sets constant the tension between the above-mentioned guidance and an electric-wire bobbin in the manufacturing installation of the stator of a dynamo-electric machine given in any 1 term of claims 1-4.

[Claim 6] The manufacture approach of the stator of the dynamo-electric machine characterized by making it synchronize with the rotation of the electric-wire bobbin which is winding said electric wire in the manufacture approach of the stator of a dynamo-electric machine which holds in the condition of having carried out shaping winding at the winding frame, having used the electric wire as the coil, and having wound the coil which carried out shaping winding, and is transferred to a coil insertion fixture, and rotating said winding frame.

[Claim 7] The manufacture approach of the stator of the dynamo-electric machine characterized by taking out the coil transferred to the above-mentioned coil insertion fixture in the manufacture approach of the stator of a dynamo-electric machine according to claim 6, and inserting in a stator core.

[Claim 8] It is the manufacture approach of the stator of the dynamo-electric machine characterized by using the revolving shaft of the above-mentioned winding frame as the revolving shaft of the above-mentioned electric-wire bobbin at parallel in the manufacture approach of the stator of a dynamo-electric machine according to claim 6 or 7.

[Claim 9] The manufacture approach of the stator of the dynamo-electric machine characterized by parallel-displacement-guiding the above-mentioned winding frame by setting the revolving shaft of a winding frame as an electric wire by the outer-diameter dimension of an electric wire for every above-mentioned winding frame rotation in the manufacture approach of the stator of a dynamo-electric machine given in any 1 term of claims 6-8.

[Claim 10] The manufacture approach of the stator of the dynamo-electric machine characterized by controlling rotation of the above-mentioned winding frame, and rotation of an electric-wire bobbin, and making regularity

tension between the above-mentioned guidance and an electric-wire bobbin in the manufacture approach of the stator of a dynamo-electric machine given in any 1 term of claims 6-9.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention relates to the highly reliable manufacturing installation and the highly reliable manufacture approach of a stator which start the manufacturing installation and the manufacture approach of a stator of a dynamo-electric machine, especially do not have poor insulation.

**[0002]**

**[Description of the Prior Art]** In dynamo-electric machines, such as a general-purpose induction motor, two or more coils which carried out shaping winding of the electric wire (magnet wire) beforehand at the predetermined coil configuration are prepared as the assembly approach of the stator, and the approach of inserting and combining them with the slot of a stator core one by one, and forming the stator is used from the former.

**[0003]** Then, the manufacture approach of the stator by such conventional manufacturing installation is explained with reference to drawing 9 - drawing 20. Drawing 9 is the appearance explanatory view of the coil insertion machine of the conventional flyer method. Drawing 10 is the winding frame of the coil insertion machine of the conventional flyer method, and the expansion explanatory view of a coil insertion fixture. Drawing 11 is the explanatory view of the 1st step of coil winding by the flyer of the coil insertion machine of the conventional flyer method. Drawing 12 is a related explanatory view of the blade, wedge guide, and winding frame in drawing 11. Drawing 13 is the explanatory view of the 2nd step of coil winding by the flyer of the coil insertion machine of the conventional flyer method. Drawing 14 is the explanatory view of the relation of the blade, wedge guide, and winding frame in drawing 13. Drawing 15 is an explanatory view of the 3rd step of coil winding by the flyer of the coil insertion machine of the conventional flyer method. Drawing 16 is the explanatory view of the relation of the blade, wedge guide, and winding frame in drawing 15. Drawing 17 is an explanatory view in the condition of having transferred the coil to the coil insertion fixture of the coil insertion machine of the conventional flyer method. Drawing 18 is the approximate account Fig. of the coil transferred to the coil insertion fixture of the coil insertion machine of the conventional flyer method. Drawing 19 is the explanatory view of the condition of winding of the coil of eye two poles in the coil insertion machine of the conventional flyer method. Drawing 20 is an explanatory view in the condition that winding of two or more poles was completed, in the coil insertion machine of the conventional flyer method.

**[0004]** The manufacturing installation of the stator of the dynamo-electric machine of the conventional example is shown in drawing 9 R> 9. As for the coil insertion fixture which the flyer which 1 rotates, the nozzle with which 2 is attached at the tip of a flyer, and 3 have in a winding frame, and 4 has in a shaping winding location, and 5, an electric wire, the coil insertion fixture with which as for an electric-wire path and 8 it has a flyer drive motor and 9 in a turntable, and 10 has [ 6 ] an electric-wire bobbin and 7 in an insertion point, and 11 are coil insertion equipment. In drawing 10, the timing pulley with which 12 was attached in the flyer drive motor 8, the timing pulley with which 13 was attached in the flyer, the timing belt which 14 delivers a rotation drive, the blade by which 15 has been arranged annularly, and 16 are wedge guides annularly arranged in contact with a blade 15.

**[0005]** About the coil insertion machine of the conventional flyer method constituted as mentioned above, the shaping winding actuation, transfer actuation of the coil to the coil insertion fixture 4, and insertion actuation of stator-core HE are explained hereafter. In drawing 11, the fixed winding frame 17 fixed had the structure where it could rush in, with few clearances in the blade 15 of the coil insertion fixture 4 by a part of winding frame 3, and 18 are the migration winding frames used as the other party. First, as shown in drawing 11 and 12, the 1st step in the winding frame 3 constituted by two or more steps rushes into the blade 15 of the coil insertion fixture 4, and a flyer 1 rotates the periphery of a winding frame 3. After carrying out count shaping winding of predetermined of electric-wire 5' drawn from the nozzle 2 in the 1st step of a winding frame 3, as shown in drawing 13 and 14, a winding

frame 3 descends and then count winding of predetermined is carried out in the 2nd step of a winding frame 3. As shown in drawing 15 and 16, after repeating this by two or more steps, as shown in drawing 17 and 18, the coil which the flyer 1 stopped, and wrote and carried out shaping winding with the dropping fixture 19 is transferred to the blade 15 of the coil insertion fixture 4, a winding frame 3 goes up, and the coil of eye one pole is completed. Next, in drawing 19, the coil insertion fixture 4 rotates and the coil of eye two poles is performed like eye one pole. Drawing 20 shows the condition that shaping winding of two or more poles was completed. Next, after moving the coil insertion fixture 4 carrying the coil 20 which carried out two or more pole shaping winding to a predetermined coil insertion point by rotating a turntable 9, it sets to the blade 15 of the coil insertion fixture 4 through the stator core which is not illustrated, and with coil insertion equipment 11, a coil 20 is inserted in a stator core and the coil for a plane 1 and insertion are completed. A repeat and a stator complete the above actuation by the need phase.

[0006] The above-mentioned conventional example could not be said to be that consideration sufficient about damage generating of the stator coil accompanying shaping winding of a stator coil and insertion and the insulating material within a slot is carried out, but the problem was in the point of insulating engine-performance maintenance. Although it is in the inclination which the miniaturization of a dynamo-electric machine and efficient-ization are cried for especially in recent years, and raises the slot internal coiling space factor (henceforth a "space factor") in a stator, the insulating coat of the electric wire accompanying the insertion of a coil which the number of the electric wire which should be inserted into an one-piece slot in this case increased, consequently carried out shaping winding, and the damage occurrence frequency of the insulating material within a slot will become high unusually. With the conventional technique, although this is rewinding the electric wire from the electric-wire bobbin by rotation of a flyer, \*\*\*\*\* produces it on the electric wire discharged from the nozzle attached in the rotating flyer. Moreover, it is because add too much tension to an electric wire by the acceleration and deceleration of a flyer, and the increase of a degree of hardness and elongation arise, so it becomes easy to damage the insulating coat of an electric wire. Moreover, it is because the intersections of electric wires occur frequently after the process inserted into the slot of a stator core, and insertion, it becomes a result and a space factor higher than original and it becomes easy to be damaged in a stator coil and the insulating material within a slot, since the electric wire by which shaping winding was carried out by the migration winding frame side to the fixed winding frame among the coils which failed to be written to the blade of a coil insertion fixture is not arranged in the sequence by which shaping winding was carried out. And as a result, poor insulation will occur frequently and the problem of the rise of the cost by the fall of dependability and the fall of the yield stopping escaping will arise.

[0007] Moreover, although it is also proposed by JP,63-42109,A etc. that rotating a winding frame and an electric-wire bobbin synchronously as coil equipment of a dynamo-electric machine is proposed by JP,2-261037,A etc., and it carries out the parallel displacement of the guidance of an electric wire to the revolving shaft of a winding frame by the outer-diameter dimension of an electric wire for every winding frame rotation, these are not taking it into consideration about the device transferred to a coil insertion fixture, either.

[0008]

[Problem(s) to be Solved by the Invention] This invention was made in view of the problem of the above-mentioned conventional technique, and the purpose is in offering the manufacturing installation and the manufacture approach of a stator of a reliable dynamo-electric machine without poor insulation.

[0009]

[Means for Solving the Problem] It is the manufacturing installation of the stator of the dynamo-electric machine which it has in the driving means which synchronizes this invention with rotation of the electric-wire bobbin which is winding said electric wire in the manufacturing installation of the stator possessing the winding means which carries out shaping winding and uses an electric wire as a coil at a winding frame, and the device which holds in the condition wound the coil which carried out shaping winding, and is transferred to a coil insertion fixture of a dynamo-electric machine, and carries out the rotation drive of said winding frame.

[0010] Moreover, this invention is the manufacturing installation of the stator of a dynamo-electric machine equipped with the extraction insertion mechanism which takes out the coil transferred to the above-mentioned coil insertion fixture, and is inserted in a stator core.

[0011] And this invention is the manufacturing installation of the stator of the dynamo-electric machine with which the revolving shaft of the above-mentioned winding frame is arranged at the revolving shaft of the above-mentioned electric-wire bobbin, and parallel.

[0012] Furthermore, the guidance to which this invention winds the above-mentioned electric wire around the above-mentioned winding frame is the manufacturing installation of the stator of the dynamo-electric machine equipped with a guidance migration means to move to the revolving shaft of a winding frame, and parallel, by the



outer-diameter dimension of an electric wire for every winding frame rotation.

[0013] Moreover, this invention is the manufacturing installation of the stator of a dynamo-electric machine equipped with the speed-control means which controls the rotational speed of the above-mentioned winding frame, and the rotational speed of the above-mentioned electric-wire bobbin, and sets constant the tension between the above-mentioned guidance and an electric-wire bobbin.

[0014] And this invention is the manufacture approach of the stator of a dynamo-electric machine which makes it synchronize with the rotation of the electric-wire bobbin which is winding said electric wire in the manufacture approach of the stator of a dynamo-electric machine which holds in the condition of having carried out shaping winding at the winding frame, having used the electric wire as the coil, and having wound the coil which carried out shaping winding, and is transferred to a coil insertion fixture, and rotates said winding frame.

[0015] Furthermore, this invention is the manufacture approach of the stator of the dynamo-electric machine which takes out the coil transferred to the above-mentioned coil insertion fixture, and is inserted in a stator core.

[0016] Moreover, this invention is the manufacture approach of the stator of the dynamo-electric machine which uses the revolving shaft of the above-mentioned winding frame as the revolving shaft of the above-mentioned electric-wire bobbin at parallel.

[0017] And this invention is the manufacture approach of the stator of a dynamo-electric machine to which it parallel-displacement-shows the above-mentioned winding frame by setting the revolving shaft of a winding frame as an electric wire by the outer-diameter dimension of an electric wire for every above-mentioned winding frame rotation.

[0018] Furthermore, this invention is the manufacture approach of the stator of the dynamo-electric machine which controls rotation of the above-mentioned winding frame, and rotation of an electric-wire bobbin, and makes regularity tension between the above-mentioned guidance and an electric-wire bobbin.

[0019]

[Embodiment of the Invention] The gestalt of implementation of invention of this invention is explained. The example of this invention is explained using a drawing. Drawing 1 is the appearance explanatory view of an example of the manufacturing installation of the stator in an example. Drawing 2 is the explanatory view showing the physical relationship of the component of the equipment of drawing 1. Drawing 3 is the explanatory view of the 1st step of coil winding initiation in an example. Drawing 4 is the explanatory view of the 2nd step of coil winding initiation in an example. Drawing 5 is the explanatory view of the coil transfer initiation in an example. Drawing 6 is the explanatory view of the coil transfer in an example. Drawing 7 is the explanatory view of the completion of a coil transfer in an example. Drawing 8 is the approximate account Fig. of the coil which coil winding of two or more poles in an example completed, and was transferred to the coil insertion fixture.

[0020] The example of the manufacturing installation of the stator of the dynamo-electric machine of this invention is explained. A winding means by which the manufacturing installation of the stator of the dynamo-electric machine of this example carries out shaping winding, and uses an electric wire as a coil at a winding frame, The device which holds in the condition of having wound the coil which carried out shaping winding, and is transferred to a coil insertion fixture, The driving means which makes it synchronize with rotation of the electric-wire bobbin which is winding said electric wire, and carries out the rotation drive of said winding frame, The extraction insertion mechanism which takes out the coil transferred to the above-mentioned coil insertion fixture, and is inserted in a stator core is provided. The revolving shaft of the above-mentioned winding frame The guidance which is arranged at the revolving shaft of the above-mentioned electric-wire bobbin, and parallel, and winds the above-mentioned electric wire around the above-mentioned winding frame It has a guidance migration means to move to the revolving shaft of a winding frame, and parallel by the outer-diameter dimension of an electric wire for every winding frame rotation, and has the speed-control means which controls the rotational speed of the above-mentioned winding frame, and the rotational speed of the above-mentioned electric-wire bobbin, and sets constant the tension between the above-mentioned guidance and an electric-wire bobbin. The winding frame which 21 rotates, and 22 in drawing 1 and drawing 2 R> 2 The revolving shaft of a winding frame 21, 23 -- a revolving shaft 22 -- an attachment \*\*\*\* timing pulley and 14 -- a timing belt -- The timing pulley with which 24 was attached in the winding frame rotation drive motor, and 25 was attached in the winding frame rotation drive motor 24, A nozzle migration device and 28 the nozzle to which 26 shows an electric wire 5, and 27 A coil transfer device, As for the coil insertion fixture with which as for an electric-wire bobbin rotation driving gear and 30 an electric-wire bobbin rotation drive motor and 31 have in a tension fixed control unit, and 4 has [ 6 ] an electric-wire bobbin and 29 in a shaping winding location, the coil insertion fixture which 10 has in a coil insertion point, and 9, a turntable and 11 are coil insertion equipment.



[0021] The nozzle migration device 27 is arranged so that a nozzle 26 may carry out parallel translation to the revolving shaft 22 of a winding frame 21, and the electric-wire bobbin rotation driving gear 29 is arranged so that the revolving shaft 22 of a winding frame 21 and the revolving shaft of the electric-wire bobbin 6 may become parallel, and it is having the rotational speed of the winding frame rotation drive motor 24 and the electric-wire bobbin rotation drive motor 30, as for the tension of an electric wire 5, controlled by the tension fixed control device 31.

[0022] The coil shaping winding actuation in the manufacturing installation of the stator of the dynamo-electric machine of this example constituted as mentioned above, coil transfer actuation of coil insertion fixture HE, and coil insertion actuation of stator-core HE are hereafter explained with reference to drawing 3 - drawing 8.

[0023] In drawing 3, it is the migration winding frame which 21a has the structure where it can rush in, with few clearances in the blade 15 and the wedge guide 16 of the coil insertion fixture 4 by a part of winding frame 21, and the fixed winding frame and 21b which rotate centering on a revolving shaft 22 become the other party, and rotates centering on a revolving shaft 22 synchronizing with fixed winding frame 21a.

[0024] In first, the condition of having held with the electric-wire holder which arranges a nozzle 26 so that an electric wire 5 may come to the location slightly higher than end-face location 21c' of 1st step 21c among the winding frames 21 constituted by two or more steps, and does not illustrate near [ an end ] 5a of an electric wire 5 A winding frame 21 is rotated with the winding frame rotation drive motor 24, and the electric wire 5 drawn by the rotation from the nozzle 26 is rolled round in accordance with the periphery configuration of a winding frame 21. Whenever a winding frame 21 makes one revolution at this time, a nozzle 26 moves upwards by the finish outer-diameter dimension of an electric wire 5 according to the nozzle migration device 27 synchronizing with rotation of a winding frame 21. By this, the intersection of electric-wire 5 comrades or too much contact can be prevented, and alignment of the electric wire 5 from the start of winding to the end can be maintained. Moreover, since the revolving shaft 22 of a winding frame 21 and the revolving shaft of the electric-wire bobbin 6 are arranged in parallel, an electric wire 5 is not twisted. Winding of several need winding minute repeat [ the 1st step of ] 21c completes this actuation, and a winding frame 21 stops by the position shown in drawing 4. next -- a nozzle -- 26 -- a nozzle -- migration -- a device -- 27 -- two or more -- a step -- constituting -- having had -- a winding frame -- 21 - - two -- a step -- \*\* -- 21 -- d -- an end face -- a location -- 21 -- d -- ' -- moving -- one -- a step -- \*\* -- 21 -- c -- shaping -- winding -- actuation -- being the same -- actuation -- the need -- winding -- several -- a minute -- repeating -- drawing 5 -- being shown -- as -- a winding frame 21 -- a position -- stopping -- the completion of shaping winding -- becoming . Henceforth, what is necessary is to establish a stage in a winding frame 21 if needed, and just to repeat the same actuation.

[0025] The electric wire 5 drawn from a nozzle 26 by rotation of a winding frame 21 here With the tension fixed control unit 31 arranged between a nozzle 26 and the electric-wire bobbin 6 Since the tension of an electric wire 5 is detected, the rotational speed of the winding frame rotation drive motor 24 and the rotational speed of the electric-wire bobbin rotation drive motor 30 are controlled according to the tension and an electric wire 5 is rewound (sending) The tension of an electric wire 5 is always kept constant irrespective of change of the peripheral velocity of a under [ the acceleration and deceleration of the winding frame rotation drive motor 24 at the time of winding initiation and termination, and one revolution of the winding frame 21 seen from the nozzle 26 ]. By this, since too much tension is not added to an electric wire 5, it can prevent to the minimum that too much elongation of an electric wire 5 and a degree of hardness increase.

[0026] Next, drawing 5 - drawing 8 explain coil transfer actuation of coil insertion fixture 4 HE. The winding frame 21 which shaping winding completed, holding the coil 32 which carried out shaping winding in the condition according to the coil transfer device 28 It is made to descend to clearance 21e of fixed winding frame 21a along with the blade 15 and the wedge guide 16 of the coil insertion fixture 4 in a coil shaping winding location. When a downward halt is carried out to the location where coil 32a of the maximum upper case of the coil 32 which carried out shaping winding is enough contained by tip 16a of the wedge guide 16 of the coil insertion fixture 4 and migration winding frame 21b carries out a parallel displacement in the direction of fixed winding frame 21a Clearance L is formed between migration winding frame 21b and a coil 32, and it has in cutting [ electric-wire ] point 5b again from near [ an end ] 5a of an electric wire with the electric-wire holder which is not illustrated in this condition. After the electric-wire cutting implement which is not illustrated cuts an electric wire 5, a transfer of the coil 32 of eye one pole [ return and ] is completed by the winding frame 21 in a rise orientation by moving to an upper orientation according to the coil transfer device 28, as shown in drawing 7.

[0027] Next, the coil insertion fixture 4 in the coil shaping winding location which transferred the coil 32 of only eye one pole is rotated in the location of a bipolar eye, and need pole repeat shaping winding and a transfer are

completed about the above shaping winding and actuation of a transfer. Shaping winding of the coil 32 of two or more poles completes drawing 8 , and the condition of having transferred to the coil insertion fixture is shown. [0028] Then, the coil insertion fixture 4 which is made to rotate a turntable 9 and is in a coil shaping winding location is moved to a coil insertion point, it inserts in the slot of the stator core which does not illustrate a coil 32 with coil insertion equipment 11, and the coil 32 for one phase is contained. The stator equipped with the repeat and the stator coil by the need phase completes the above shaping winding, a transfer, insertion, and actuation of receipt.

[0029] Thus, in this example, since shaping winding is not performed [ while twisting an electric wire, and ] like the conventional technique, making it increase elongation and a degree of hardness, it can transfer, holding alignment to the blade of a stator coil insertion fixture. Therefore, since the intersection of the electric wires within a slot can be decreased even if it carries out the insertion receipt of the coil into the slot of a stator core, damage is not done to an electric wire and the insulating material within a slot.

[0030]

[Effect of the Invention] According to this invention, since a twist of an electric wire and elongation are held to shaping winding and a coil insertion fixture at its minimum at alignment, the stator of the high-reliability which can insert so that the intersection of the electric wire within a slot may be decreased, consequently does not have poor insulation can be obtained easily.

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1] The appearance explanatory view of an example of the manufacturing installation of the stator in an example.

[Drawing 2] The explanatory view showing the physical relationship of the component of the equipment of drawing 1.

[Drawing 3] The explanatory view of the 1st step of coil winding initiation in an example.

[Drawing 4] The explanatory view of the 2nd step of coil winding initiation in an example.

[Drawing 5] The explanatory view of the coil transfer initiation in an example.

[Drawing 6] The explanatory view of the coil transfer in an example.

[Drawing 7] The explanatory view of the completion of a coil transfer in an example.

[Drawing 8] The approximate account Fig. of the coil which coil winding of two or more poles in an example completed, and was transferred to the coil insertion fixture.

[Drawing 9] The appearance explanatory view of the coil insertion machine of the conventional flyer method.

[Drawing 10] The winding frame of the coil insertion machine of the conventional flyer method, and the expansion explanatory view of a coil insertion fixture.

[Drawing 11] The explanatory view of the 1st step of coil winding by the flyer of the coil insertion machine of the conventional flyer method.

[Drawing 12] The blade in drawing 11, the related explanatory view of a wedge guide and a winding frame.

[Drawing 13] The explanatory view of the 2nd step of coil winding by the flyer of the coil insertion machine of the conventional flyer method.

[Drawing 14] The explanatory view of the relation of the blade, wedge guide, and winding frame in drawing 13.

[Drawing 15] The explanatory view of the 3rd step of coil winding by the flyer of the coil insertion machine of the conventional flyer method.

[Drawing 16] The explanatory view of the relation of the blade, wedge guide, and winding frame in drawing 15.

[Drawing 17] The explanatory view in the condition of having transferred the coil to the coil insertion fixture of the coil insertion machine of the conventional flyer method.

[Drawing 18] The approximate account Fig. of the coil transferred to the coil insertion fixture of the coil insertion machine of the conventional flyer method.

[Drawing 19] It sets to the coil insertion machine of the conventional flyer method, and is the explanatory view of the condition of winding of the coil of eye two poles.

[Drawing 20] The explanatory view in the condition that winding of two or more poles was completed in the coil insertion machine of the conventional flyer method.

**[Description of Notations]**

1 Flyer

2 Nozzle

3 Winding Frame 4 Coil Insertion Fixture

5 Electric Wire

5a Near an end

6 Electric-Wire Bobbin

7 Electric-Wire Path

8 Flyer Drive Motor

9 Turntable

10 Coil Insertion Fixture



11 Coil Insertion Equipment  
12 Timing Pulley  
13 Timing Pulley  
14 Timing Belt  
15 Blade  
16 Wedge Guide  
16a Tip  
17 Fixed Winding Frame  
18 Migration Winding Frame  
19 Write and it is Dropping Fixture.  
20 Coil  
21 Winding Frame  
21a Fixed winding frame  
21b Migration winding frame  
21c The 1st step  
21c' End-face location  
21d The 2nd step  
21d' End-face location  
21e Clearance  
22 Revolving Shaft  
23 Timing Pulley  
24 Winding Frame Rotation Drive Motor  
25 Timing Pulley  
26 Nozzle  
27 Nozzle Migration Device  
28 Coil Transfer Device  
29 Electric-Wire Bobbin Rotation Driving Gear  
30 Electric-Wire Bobbin Rotation Drive Motor  
31 Tension Fixed Control Unit  
32 Coil  
32a The coil of the maximum upper case

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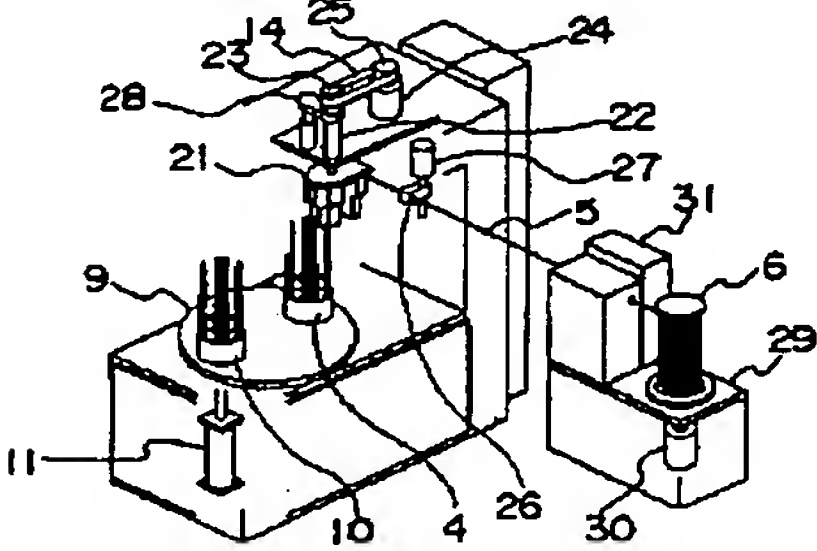
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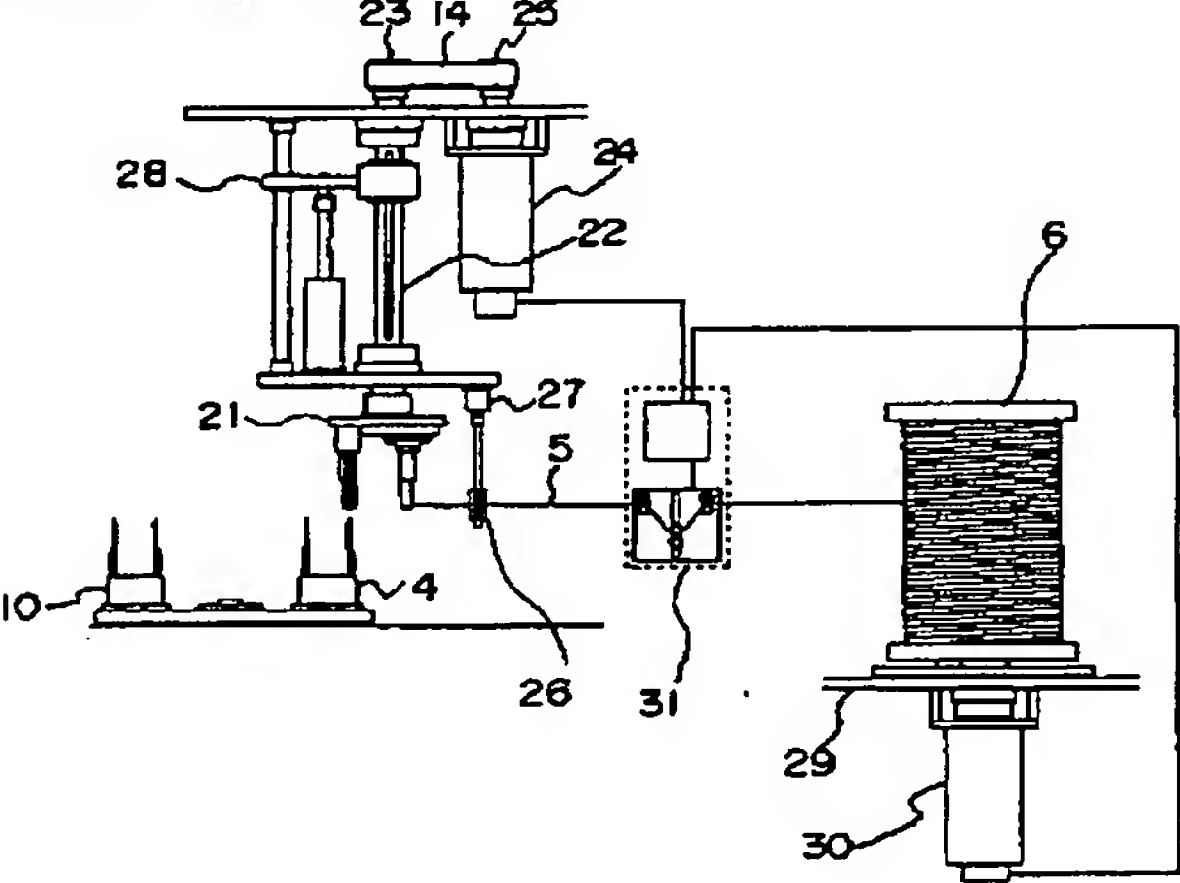
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DRAWINGS

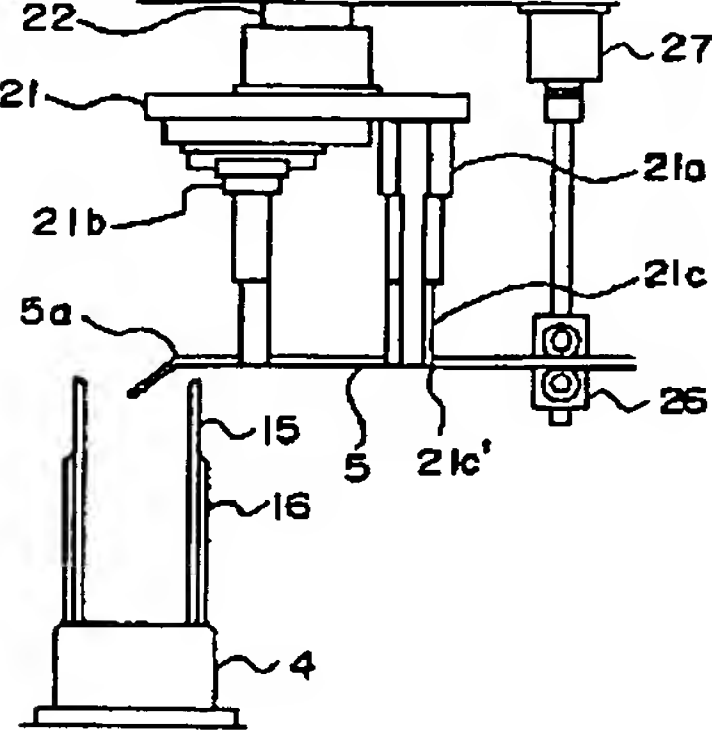
[Drawing 1]



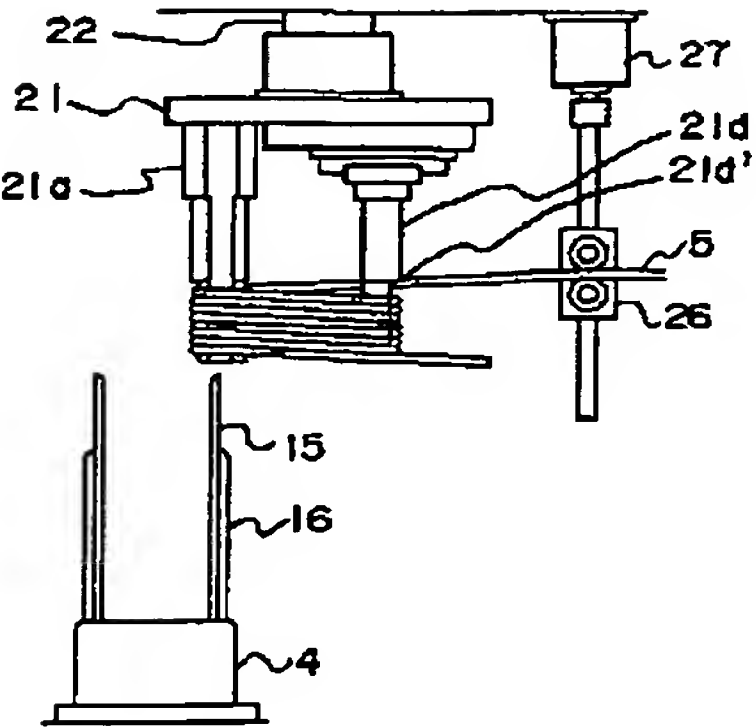
[Drawing 2]



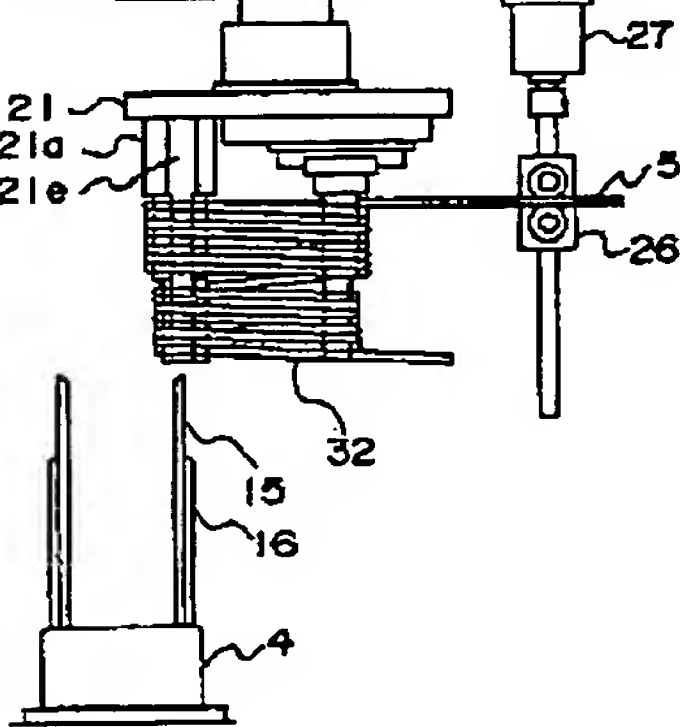
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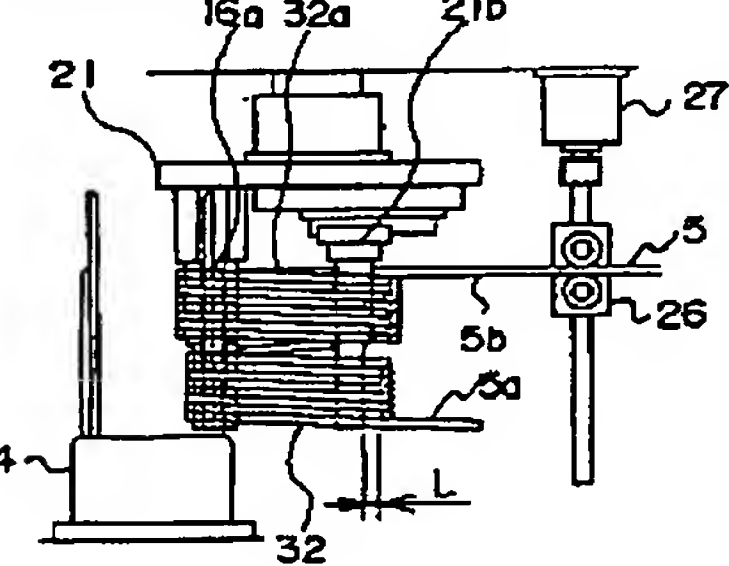
[Drawing 4]



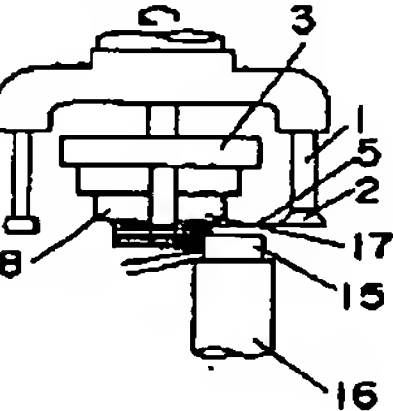
[Drawing 5]



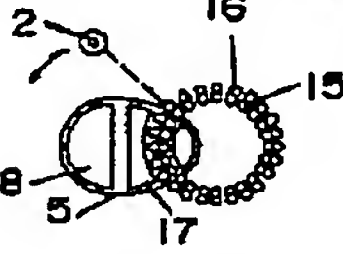
[Drawing 6]



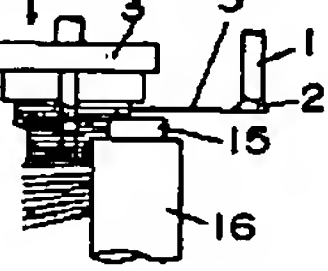
[Drawing 11]



[Drawing 12]

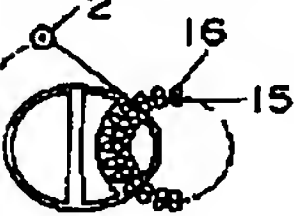


[Drawing 13]

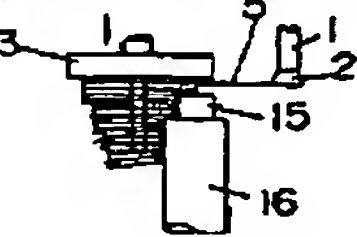




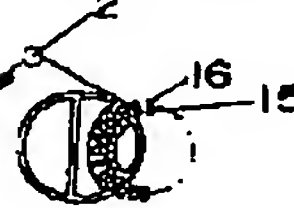
[Drawing 14]



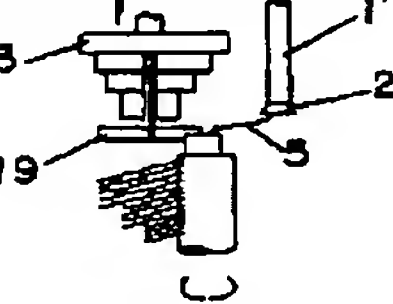
[Drawing 15]



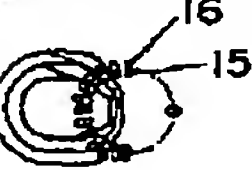
[Drawing 16]



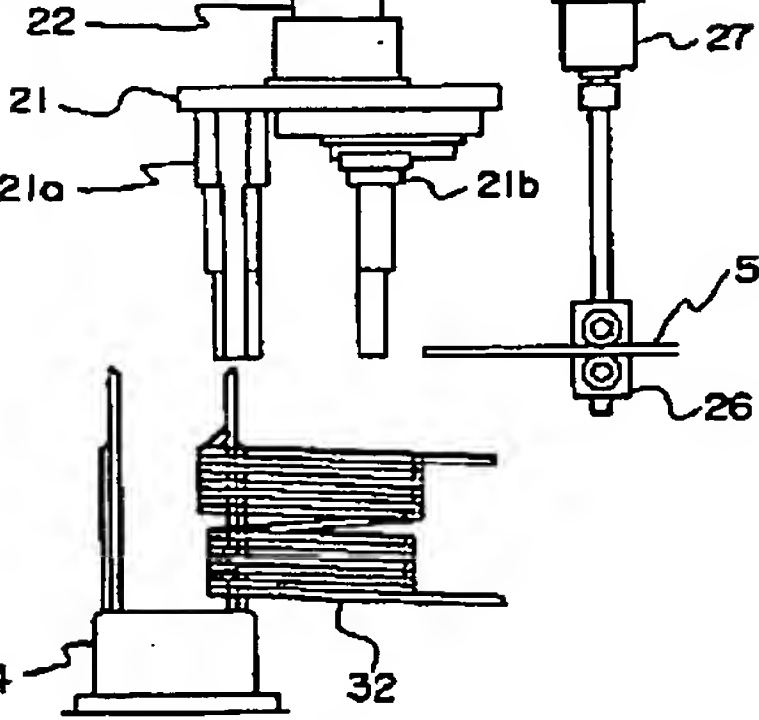
[Drawing 17]



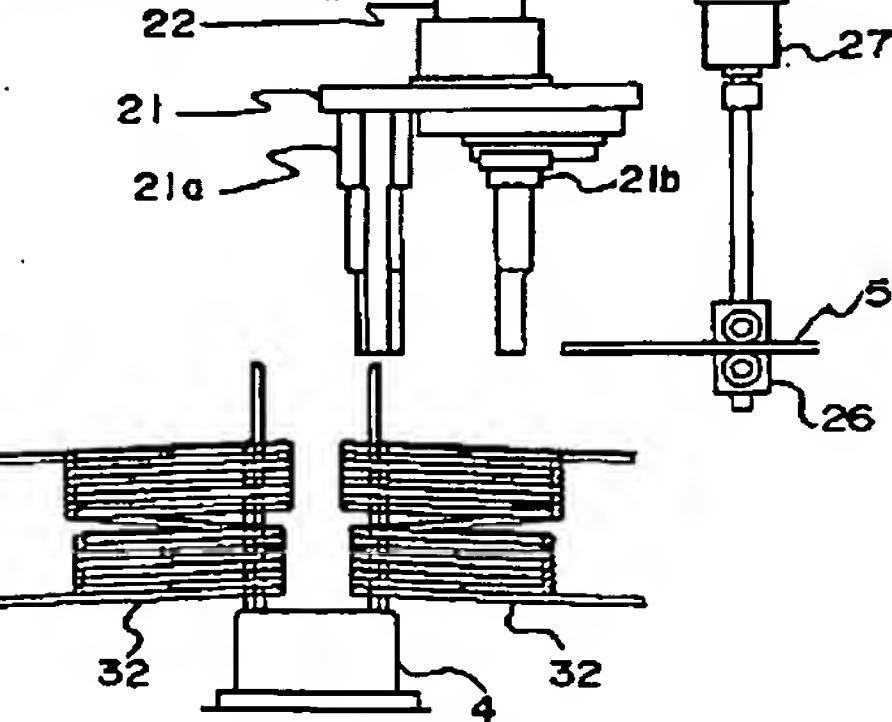
[Drawing 18]



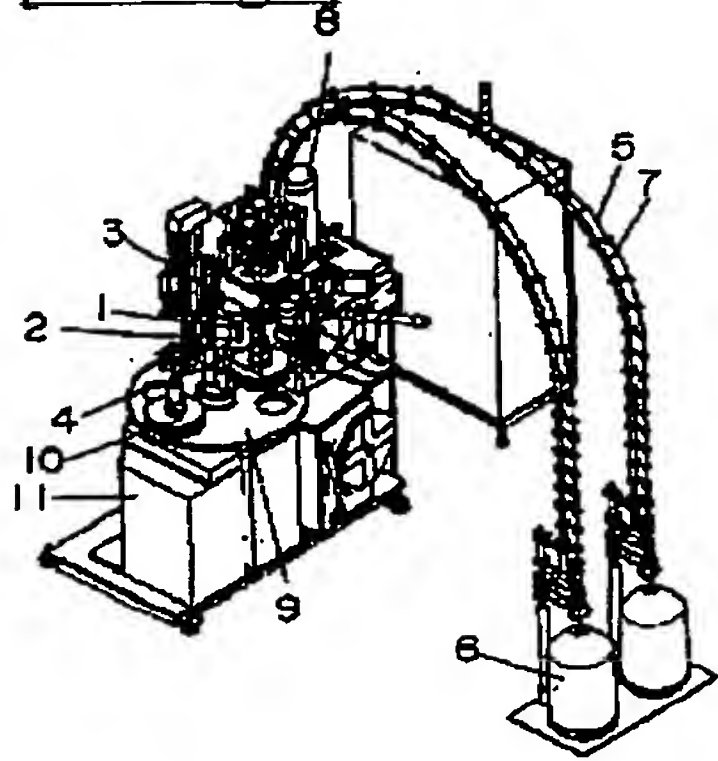
[Drawing 7]



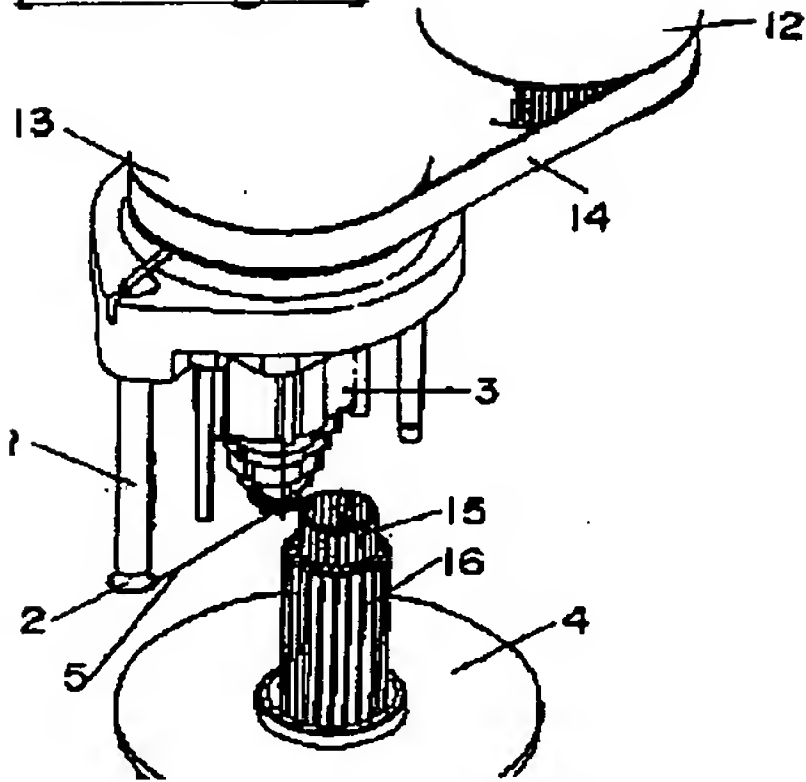
[Drawing 8]



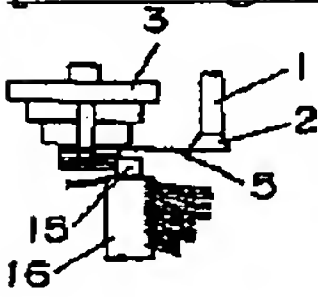
[Drawing 9]



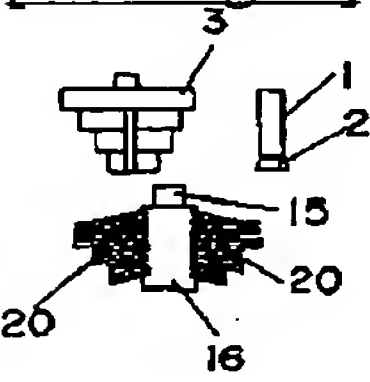
[Drawing 10]



[Drawing 19]



[Drawing 20]



[Translation done.]